DRIVER

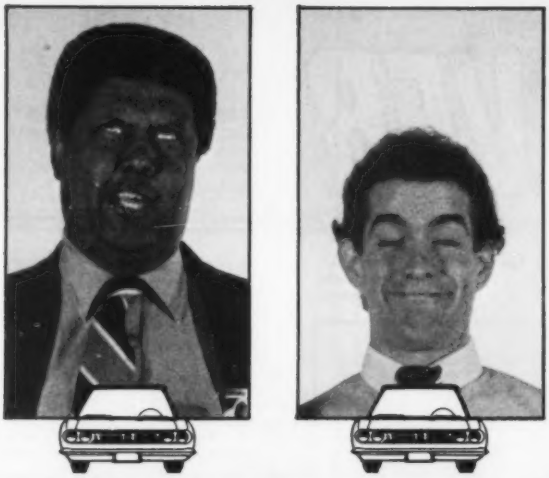
JUNE 1984

HEAVY DRINKER or LIGHT DRINKER?

BOOZE and ARROWS

CAR and BOTTLE issue

DRIVER



HEAVY DRINKER or LIGHT DRINKER?

The difference between a light drinker and heavy drinker might be a difference in life style. The light drinker might consume alcohol on occasion or regularly, but not "to excess." To the light drinker, drinking might be a social activity, a part of amusing oneself. The heavy drinker might drink a lot, both in frequency and in amount. For the heavy drinker, getting drunk can be the main goal of leisure time, an end in itself.

The difference may be reduced somewhat when the drinker, heavy or light, tries to perform the complex visual and physical activity known as driving an automobile. This is because alcohol equals impairment. Any amount of alcohol will interfere with your ability to drive a car. You do not drink and drink and then suddenly, at some magic point, lose the ability to drive safely. The effects of alcohol are progressive; they increase as the amount of alcohol in your system increases.

If you are a heavy drinker you may think you can drink and then drive safely because you can "hold your liquor." If you're a light drinker you may think you can drive safely after "a few drinks" because you don't consume that much. Well, we're here to tell you that alcohol's effects are many and complex. This article will be an attempt to show how complicated it is to predict what those effects will be, whatever your intake, and to convince you to use the bottle and the car keys at different times.

Legal limits: The law enforcement authorities must have some standard measure by which they can judge when a person is too drunk to drive, and therefore they have the measure known as Blood Alcohol Level or Blood Alcohol Content (BAL or BAC). At what is called a "point-one Blood Alcohol Level" (.1 BAL), a ratio of the amount of alcohol to the amount of blood, a person is judged to be legally intoxicated. This is a percentage equaling one part alcohol to 1000 parts blood. It's not a large amount.

It has been estimated that the probability of a traffic accident when the driver is at .1 BAL is 600 to 800 percent over the probability when the driver is sober. Those high numbers sound impressive, but it doesn't necessarily take that high an intoxication level to cause an accident. Accidents often occur with drivers at lower levels of drunkenness like .06, when the likelihood is around twice that for a sober driver, or even lower levels.

So it's not just the heavy drinker who causes an automobile mishap. Sometimes it's the light or "social" drinker.

Depressant: Why does alcohol have this kind of effect? Because it is basically a depressant of the central nervous system. That is, it has a generalized effect of lowering all bodily functions, from mental activity to physical coordination to vital functions like breathing. The extent of alcohol's effect depends on the amount consumed.

Trying to do a complex task like driving when you're under the influence of alcohol is almost like trying to do it under an anesthetic. Alcohol relaxes the drinker. It interferes with the judgment and the thinking, causing the drinker to have a faulty perception of his condition. (He usually thinks he's sober.) More alcohol in the body makes him drowsy, slows his reaction time, dulls his senses and messes up his coordination and balance. If he keeps on drinking, everything conks out and he loses consciousness.

That's a general look at the effects, and we can get more specific, based on the usual effects at various Blood Alcohol Levels. However, we must alert the

continued

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Maj Gen JOHN H. MITCHELL
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TINA M. PALMER
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Staff Artist

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heavy drinker or light drinker?

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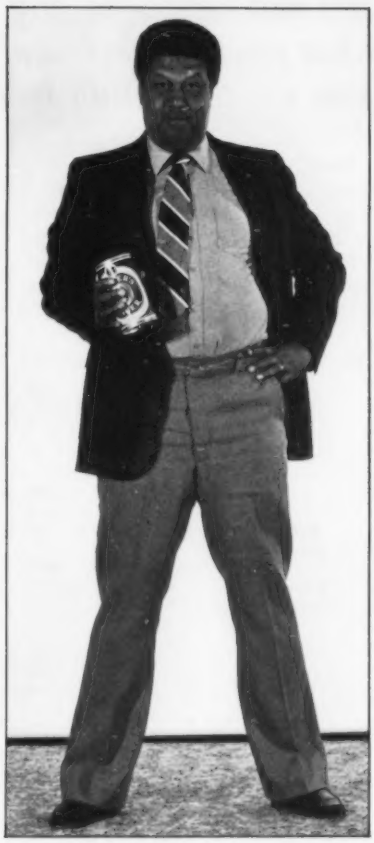


reader that these BAL figures are approximations. The observable effects at any level of intoxication will vary from one individual to another.

Progressive effects: We also must warn again that drunkenness is not an "either/or" situation; it's a progression. People often look at the ".1 BAL" figure as the dividing line for drunkenness, as though .1 is "drunk" and anything less is "sober." But it's not so simple as that. "Drunk" is a relative condition. At lower levels of intoxication than .1, sometimes much lower levels, people are impaired beyond the point of safety.

For instance, at a Blood Alcohol Level of only .02, the drinker will experience a loss of restraint and awareness. He or she will be overconfident and careless.

An interesting fact is that at this level, five percent of the population will be too drunk to drive, yet nobody outwardly appears to be intoxicated.

By the time a BAL of .04 is reached, there is an additional loss of comprehension and concentration. The driver becomes inattentive, easily distracted and impulsive. At this BAL, 15 percent of the drivers are too intoxicated to drive safely, but only five percent of the total will show it.

Let's move on to a Blood Alcohol Content of .06. Now, a loss of judgment is added to the other symptoms. The driver is hesitant and indecisive and makes mistakes. At this point, 35 percent of the drivers are too drunk to drive, but only one in ten will look that way.

Now we're at .08 BAL. Small muscle control is impaired, and there is a loss of sensation. Depth perception, glare recovery, peripheral vision and even visual focus are all affected. Sixty-five percent of the population will be too drunk to drive at this level, but only 20 percent will look that way.

continued

It's not only who you are, it's also what you consume, and how fast, and any number of other factors, that will you get too drunk to drive.

Okay, now the "magic" level of .1 Blood Alcohol Level, the legal definition of intoxication. In addition to all the other losses in the driving ability, coordination is lost. Here is where we see oversteering, drifting in the lane, and changes in speed while driving. Everybody, 100 percent of the population, will be too drunk to drive at this point, but only 40 percent — less than half — will show the outward signs.

At higher levels of alcohol, the drinker will lose control of the larger muscles, balance and even consciousness.

BAL CHART

	1 Drink				2 Drinks				3 Drinks				4 Drinks			
After hours	**4**	**3**	**2**	**1**	**4**	**3**	**2**	**1**	**4**	**3**	**2**	**1**	**4**	**3**	**2**	**1**
Weight pounds																
80	—	—	—	.02	—	—	.05	.08	.07	.10	.10	.10	.12	.12	.15	.15
100	—	—	—	.02	—	—	.04	.06	.05	.07	.08	.09	.09	.10	.12	.13
120	—	—	—	.02	—	—	.03	.04	.03	.04	.06	.08	.06	.08	.09	.11
140	—	—	—	.01	—	—	.02	.04	.02	.03	.05	.06	.04	.06	.08	.09
160	—	—	—	.01	—	—	.02	.03	.01	.02	.04	.05	.03	.04	.06	.08
180	—	—	—	.01	—	—	.01	.03	—	.02	.03	.04	.02	.04	.05	.07
200	—	—	—	—	—	—	.01	.02	—	.01	.03	.04	.01	.03	.04	.06

	5 Drinks				6 Drinks				7 Drinks				8 Drinks			
After hours	**4**	**3**	**2**	**1**	**4**	**3**	**2**	**1**	**4**	**3**	**2**	**1**	**4**	**3**	**2**	**1**
Weight pounds																
80	.17	.17	.19	.20	.19	.22	.22	.25	.25	.27	.27	.30	.29	.30	.32	.33
100	.13	.14	.16	.17	.16	.18	.19	.21	.20	.22	.23	.25	.24	.25	.27	.28
120	.09	.11	.13	.14	.13	.14	.16	.17	.15	.17	.19	.20	.19	.20	.22	.23
140	.07	.09	.10	.12	.10	.12	.13	.15	.13	.14	.16	.17	.15	.17	.18	.20
160	.06	.07	.09	.10	.08	.09	.11	.13	.10	.12	.13	.15	.13	.14	.16	.17
180	.04	.06	.07	.09	.06	.08	.09	.11	.09	.10	.12	.13	.11	.12	.14	.15
200	.03	.04	.06	.08	.05	.07	.08	.09	.07	.09	.10	.12	.09	.10	.12	.13

Numbers equal the percentage of alcohol in the blood. Dash (—) = a trace of alcohol.

Use this chart as a guide to tell you how much you can drink. The chart supposes that you've eaten, and are drinking an "average" drink. BALs for people with empty stomachs, and for those drinking more potent drinks (martinis, manhattans, "doubles," and the like) will be higher.

Approximations: Are you getting the picture? Intoxication is a *progression.* You can look at the numerical charts to judge when you might reach each BAC level. The charts can be somewhat educational. We've even printed one on this page.

But these things are all approximations. It's not so simple as finding your weight and the number of drinks and seeing how drunk you are. There are many different factors that will affect how drunk a person will become and how fast. It's an inexact science.

A lot of people look upon drinking this way: "What does it take to get intoxicated beyond the legal limit for safe driving? It's important to know the precise amount I can safely consume if I want to avoid being stopped and arrested by the authorities."

Well, if you're a fairly large person, say 200 pounds, you could have six drinks in an hour and still remain under the legal limit of .1 BAL. And if you're a small person, about 100 pounds, three drinks within one hour would put you at about the same level, a .09 BAL. That's pretty handy to know, isn't it?

Don't assume: But wait a minute. It's not so simple as that, and we don't want you to assume you can necessarily drink that much. There are many factors affecting a person's reaction to alcohol, and those numbers only account for a couple of them, body weight and speed of con-

Party Animal? _____

It is often the case that the person who drinks heavily is considered a "real man," worthy of respect. Or, if the heavy drinker is a woman, she is said to be able to "drink you under the table," and is looked upon with awe. Somehow, the ability to drink a lot and "hold your liquor" is a mark of some kind of status to some people.

The heavy drinker is far from being the stereotyped, fun-loving "party animal," according to work done by

continued

determine when

sumption. Since we took those numbers from the BAL chart, they also assume the person has something in his stomach.

Physical size and drinking rate are perhaps the most important factors in determining how drunk a person will get and how fast. But there are other factors that the numbers on charts don't account for. What if the drinker is not drinking an "average" drink. What if he's drinking more potent drinks, like doubles? What is the person's individual tolerance for alcohol, both in his or her chemistry and in drinking experience? What mood is the drinker in?

Following are some of those factors. Some of them relate to the "heavy drinker versus light drinker" question. First, the physical factors.

Body weight: The more body weight a person has, the more he or she can drink. It's a simple matter of the amount of blood a person has. Since alcohol is diluted in the body fluids, the more blood there is, the less concentrated will be the alcohol. This will mean that the heavy person can more easily be a heavy drinker.

All other things being equal, a lighter person will generally have to be a lighter drinker because there is less blood to dilute the alcohol.

Drinking rate: The speed with which you put it away will affect your relative sobriety, but in order to talk about how fast alcohol goes in, we must explain how fast it goes out.

How does it get out (and it must get out, since it's basically a toxic substance)? A small amount of alcohol is eliminated through the urine and the sweat (and even a little in exhaled breath). But by far the most, over 90 percent, goes through the liver to be detoxified. Unfortunately, the liver gets overworked.

The human liver was just not meant to detoxify alcohol in the amounts a lot of people pour through their bodies. The average-sized man can metabolize about a third of an ounce of pure alcohol an hour. (True, a larger person will have a

continued

alcohol researcher Dr. Frederick L. McGuire of the University of California at Irvine.

When compared to light drinkers, Dr. McGuire says heavy drinkers are less restrained, more impulsive, less self-controlled, and more likely to profess a carefree attitude toward life. They are less socially aggressive, and more likely to follow than to lead. They try to be less conspicuous and are hesitant to speak out. They are shy, disliking social contact and the limelight.

They have greater swings in their mood, and are more likely to be depressed and pessimistic and to feel guilty, lonely or worried. They tend to be more "thin-skinned" and self-centered and to suspect others of being hostile toward them. Finally, they tend to be less defensive about admitting to faults and socially undesirable traits.

This gives a picture of a less self-assured person, who perhaps uses alcohol to break out of a shell, or to stop thinking about the disappointments of life.

So much for the "party animal."

(McGuire, F.L., Heavy and Light drinking drinkers as separate target groups for treatment. *American Journal of Drug and Alcohol Abuse*, 1980, 7(1), 101-107.)

larger liver, but even larger people will metabolize less than an ounce of alcohol an hour.) Most drinks contain over half an ounce of pure alcohol, at least, and most people drink more than just one drink per hour.

So the liver gets behind in its job because the liver's owner doesn't respect its limitations. This is what happens when a person gets drunk: The liquor goes in faster than the body can get rid of it, just like a sink will get full if you run water in faster than it can go down the drain.

The heavy drinker may drink faster or he may drink for a longer time; whichever, the intake is more. The light drinker probably drinks at a slower rate. But even the so-called "light" drinker will get drunk if he exceeds his body's ability to get the alcohol out.

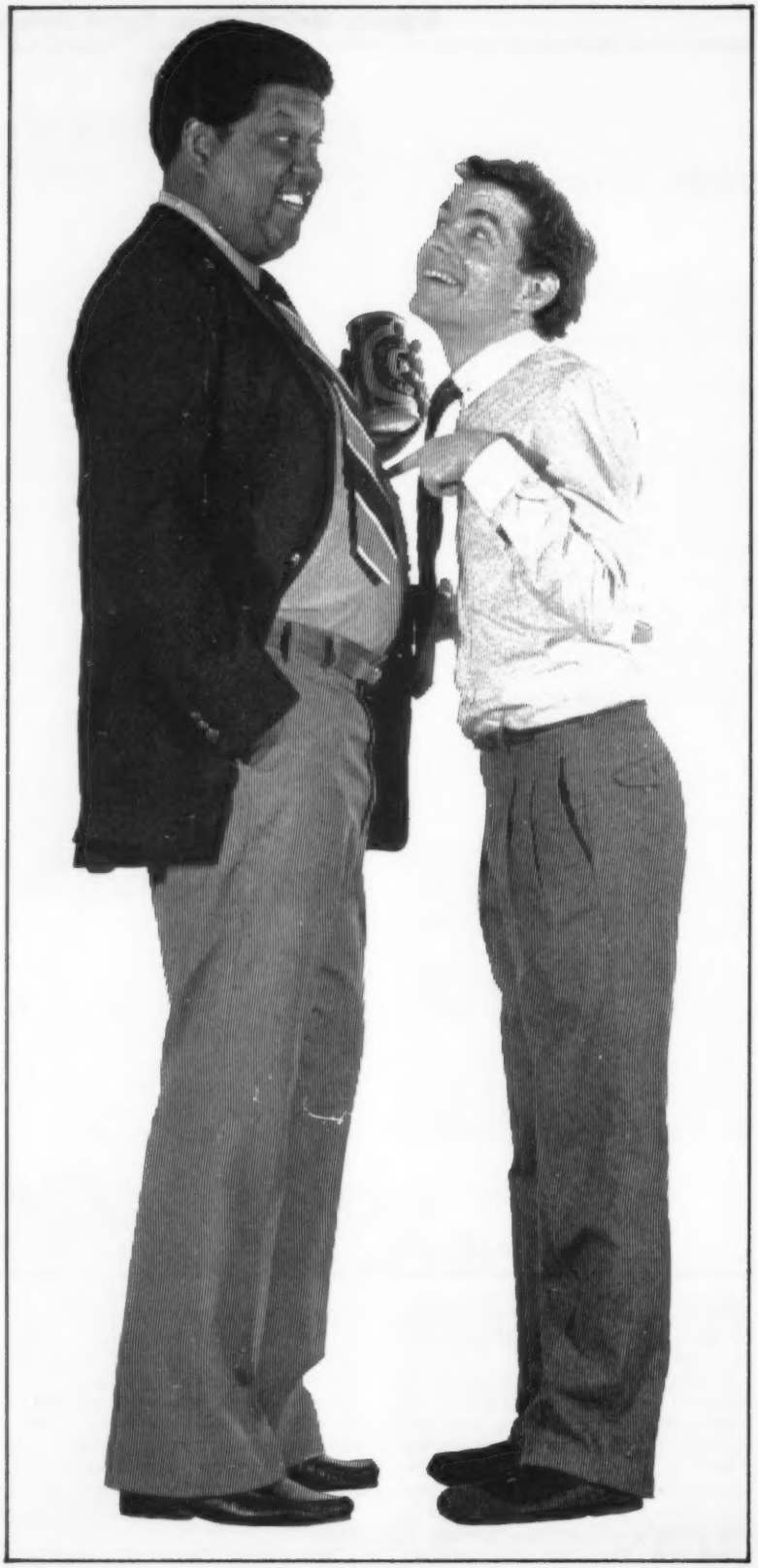
Body chemistry: Some people can tolerate alcohol easier than others, due to their chemical makeup. The habitual heavy drinker obviously can. It's more difficult to say with the light drinker. He or she may drink less because of lack of tolerance, or just as a matter of choice.

Food: Food in the stomach slows the absorption of alcohol into the body. With food inside, the stomach has to process more than just alcohol. With only alcohol, the booze gets top priority and it reaches the bloodstream quicker.

Type of beverage: Although the difference isn't as great as some would like to believe, the type of drink you have will affect the state of drunkenness. Wine and beer, because they are more diluted solutions of alcohol, will affect the body slower than distilled spirits. Heavy drinkers and light drinkers both consume all different kinds of alcoholic beverages, so there is not a "heavy drinker's beverage" or "light drinker's choice." This includes the so-called "light beers," because a heavy drinker will simply drink more cans of light beer.

We want to clear up a possible misconception, and that is the amount of alcohol in a drink. Many people refer to their favorite beverage with statements of "it's 'only' wine," or "it's 'only' beer," as though to belittle the amount of alcohol contained in those two drinks.

There is roughly as much pure alcohol in one glass of wine or in one beer as there is in one mixed drink. It's just that the wine and the beer are more dilute



solutions. As we have suggested, there are variations such as the "light" beers, and there are also more potent drinks that contain more alcohol — martinis, manhattans and the like. But we won't let you get away with calling yourself a "light drinker" just because you "only" drink beer.

There are also some psychological factors that affect how people drink.

Situation: Who the drinker is with and where he or she is will determine the amount of drinking. A person will possibly drink more with friends in front of a TV football game than at an office party where he or she is trying to impress a superior.

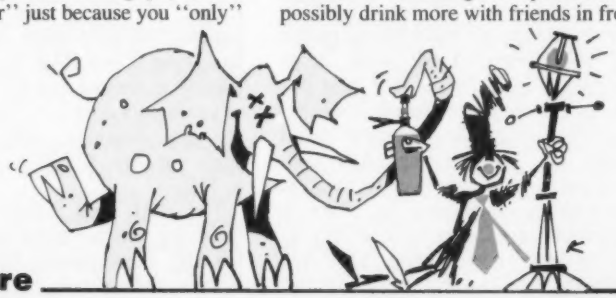
Mood and reasons: Mood will affect people differently. In a good mood, a person may want to drink only a little, or perhaps a lot, to heighten the feeling. Under a lot of stress, a person might drink a lot, to forget the problems. There are many reasons that might affect the amount you drink. You might drink to relax, to avoid problems, to show off, or as an excuse to let go of some inhibitions. It's a very individual thing.

Attitude: Likewise, one's attitudes towards alcohol will be very individual. Some people see it as something to be used very sparingly, and others will pour it down with no thought of moderation.

Experience: Drinking experience will affect the outward signs of drunkenness. An experienced drinker can mask his reactions to the alcohol and give the appearance of being unaffected by it, to a point. He perhaps knows when it is affecting him and at least *should* know when to stop. A heavy drinker is more likely to be experienced. The non-experienced drinker has less knowledge and less control over the outward evidence of drunkenness.

You may have seen where we were heading with this: Alcohol's effects are predictable — the stuff will mess up your ability to drive. But the effects are not so predictable as to how much a person can consume and still be safe at the wheel of a car, whether that person is a heavy drinker or a light drinker.

The best way to make sure that you will be a safe driver is to control *all* the variables of drunkenness — if you're going to drive anywhere, don't drink. It's old advice, but it's still true.



The Cure

You could be a "light drinker" or a "heavy drinker," but you've had a few too many at a party or at a bar and you want to "sober up" before risking the drive home. You want to avoid attracting the attention of the police. What do you do to get sober?

There isn't a lot you can do. You do not "sober yourself up"; that is done for you. But the catch is that it's done very slowly. Remember the discussion on the liver?

Cold showers won't help. They may help you shake off a little sleepiness (temporarily), but your reaction time is still slower, and your coordination and judgment are still off. You're still drunk.

Hot coffee won't help. In fact it might make your driving performance worse. (See "Whiskey, with a Coffee Chaser," November 1983 DRIVER). Your eyes may be open a little wider, but you're still drunk.

And so on with the other quick cures for drunkenness. The best way to sober up now is to find a place for a snooze. (*Walk* do not drive.) It'll take time.

How I became one of THEM

1st Lt THOMAS SHELTON ALSUP
90th Strategic Missile Wing
F.E. Warren AFB, Wyo.

THEY say seat belts save lives. THEY say driver fatigue causes accidents. THEY say speed kills. THEY are also the ones who experience automobile accidents, not ME. But sooner or later THEY had to become ME; it was just a matter of time before the odds caught up. Since I am now THEY, I can speak with the voice of experience. Before you dismiss me as just another one of THEM, consider the fact that not long ago I was one of YOU.

Maybe you've never been involved in a traffic accident. If that's the case, you are very fortunate. You are probably a good driver. You have probably seen some near misses and learned from them. But it is also probable that one day your luck will run out; and if that happens on a day that your driving skills are in a slump and you aren't quite as alert as usual, it's possible the accident might even be partly your fault.

I don't mean to suggest that a traffic accident is inevitable. It is possible that you will spend many years behind the wheel and never experience the horror of an accident with injuries or the cursed inconvenience of a minor fender bender. But the odds are not on your side. To increase your chances of not having an accident (or not having ANOTHER accident) you should listen to the voices of experience and learn from THEIR mistakes. Believe it or not, some of THEM who constantly preach safe driving were once good, practical, and sensible drivers like yourself.

My brother Steve and I are committed vacationers. We both managed to find jobs with considerable vacation time; I have my 30 days per year (although I can't take it all at once) and he is a schoolteacher so he gets most of the summer off. Our definition of a good time is to camp on top of a cold, windy mountain in the middle of nowhere, and the next night camp on a cold, windy mountain several hundred miles away over treacherous roads. We like to travel; it's nothing for us to plan a 3000 mile vacation and end up driving 4000 miles.

Of course, the Air Force recommends a much easier regimen of driving than what the Alsup brothers traditionally attempt. According to THEM, you should drive only 400 miles per day. You should stop every hour for 10 minutes of rest. But that kind of schedule would leave Steve and I stuck somewhere between Spokane and Flagstaff at the end of my leave if we adhered to it. So we drive on, letting our destination determine our speed and driving time, even though we both know that what we are doing is probably not wise. But since we are indestructible (pity the poor heathen who are prone to accidents and other bothers) we know that nothing is going to happen to US.

Steve had taken a bus from southern Missouri to Cheyenne, Wyo. It is impossible to rest on a bus, so he was pretty tired when he finally arrived on the afternoon before my leave began. Naturally we stayed up late; traditions must be observed, etc. But by 4:30 a.m. we were on our way to points northwest. After a short stay in Yellowstone National Park (a nice place, but we had been there before and our main interest on this trip lay elsewhere) we went on to somewhere in Montana. The next day took us through Idaho and into Washington, where we put up camp near Mount Rainer (yes, it was raining). After that, a comparatively short drive to a beautiful mountaintop hideaway in absolute wilderness near Crater Lake in Oregon. Keep in mind we were doing a great deal of driving AND a great deal of hiking!

After seeing some of the sites of Oregon (or was it all just a blur?) we took in the northern California coast and the Redwoods. The next day was spent negotiating the California roads and blazing well into Nevada. In Provo, Utah, we looked up an old friend and "relaxed" for a day. After the friendship had been sufficiently renewed and it was time for us to go, we were really looking forward to camping again in the Utah mountains. That afternoon, on a straight, nearly deserted stretch of highway, the unwavering luck of the Alsup brothers finally ran out.

In the Great American West there is often considerable advantage to be gained by exceeding the speed limit. And why not? It's not like New Jersey or eastern Massachusetts or Washington, D.C., home of the politicians who dictate the speed laws for the western expanse. Other motorists are few and far between, you can often see for miles and there just aren't any cops anywhere. And as everyone who has ever driven across the desert can attest, it's hard to keep it below 55 miles per hour unless you have cruise control. It's also boring. And you can't help but calculate how much time you could save if you drove the next 500 miles at 60, 65, 70 or whatever. And if we get to so-and-so by such-and-such, we can make camp in the shadow of Mount Greatspectacularfantastic, and the 55 mile per hour speed limit is unpopular out here anyway, and obviously nobody abides by it, etc., ad infinitum.

There is something about driving great distances which dulls your senses. You become complacent and lax in obeying the traffic laws. Speeding aside, there are other little ridiculous laws such as "signal before a turn, even if you are lost in the middle of nowhere and no one is within 100 miles" and "don't pass anyone if the solid yellow line is in your lane, even if you CAN see forever and nobody is coming and the guy in front of you is only doing 45." Laws like that are generalizations; surely they don't apply out here. Surely they don't apply to ME.

The 1961 Ford pickup I had been following was not going fast enough. I felt OK about passing him because I didn't even have to go that much over the speed limit to do it. During the past 2500 miles I had passed several cars that were going much faster. He was doing less than 55 and seemed to be slowing down, ever so slightly. The road was straight and clear. Nobody was coming. Nobody was behind me. We were looking forward to a relaxing evening in the nearby mountains and we weren't even in a hurry. We were just in that mode which

says "go, go, go!" So I signaled and started to zip around him, just like I had done so many times before. I didn't even notice the ridiculous little yellow line; it probably wouldn't have made much difference had I seen it.

What I did notice was the fact that he was veering into the left lane just as I got my speed up. He wasn't signaling and he was going way too fast to turn, but I applied the brakes anyway. Good thing. The road to his house took off to the left at a 45 degree angle. He didn't have to slow down that much to make the turn, and his truck didn't even possess a signal (neither did it possess a registration, much to his chagrin). I could have taken to the ditch on the left, but that would have caused me to broadside him. Besides, taking to the ditch on the left is not something you normally think of. I could have tried to reverse my momentum and sneak behind him on the right, but I would have probably struck his bumper in the vicinity of my door. The luck of the Alsup brothers was not completely gone, because my reflexes served me as well as could be expected. I just stood on the brakes and was able to reduce speed considerably before the corner of his solid steel rear bumper slammed through the plastic grill of my little Datsun.

There is no sound like the sound my brother and I heard that day. It is a sickening crunch. Steve said he heard a profane word, but he wasn't sure which one of us said it. We were both wearing seat belts (which contributes immeasurably to good luck) and came away with no serious injuries, except for some minor bruises caused by camping gear that suddenly became hostile. The sight of my pretty gold colored hood coming at me in the form of twisted metal is one I will not soon forget. But the sound; that sickening sound!

It's amazing how you can drive all day and never see a cop. But when you are sitting by the side of the road with a pile of junk that looks like it used to be somebody's car, the patrolmen and sheriff's deputies seem to come out of the woodwork. Within a very few minutes there was a "good old boy" with a western drawl making measurements and taking statements.

The driver of the truck turned out to be 19 years old. He was dressed up like an old west outlaw, complete with cowboy hat, wild look in his eye, scraggly beard and gun (which caused Steve and I some concern when we first saw him emerge from his truck). But he turned out to be one of the bad guys for an old west show, just coming home from a hard day of holding up tourists. The wild look in his eye looked very much like it was caused by frequent use of an unauthorized substance. His truck was not registered. His signals were inoperative, and he admitted that he didn't bother to use hand signals. The good old boy with the badge was not impressed.

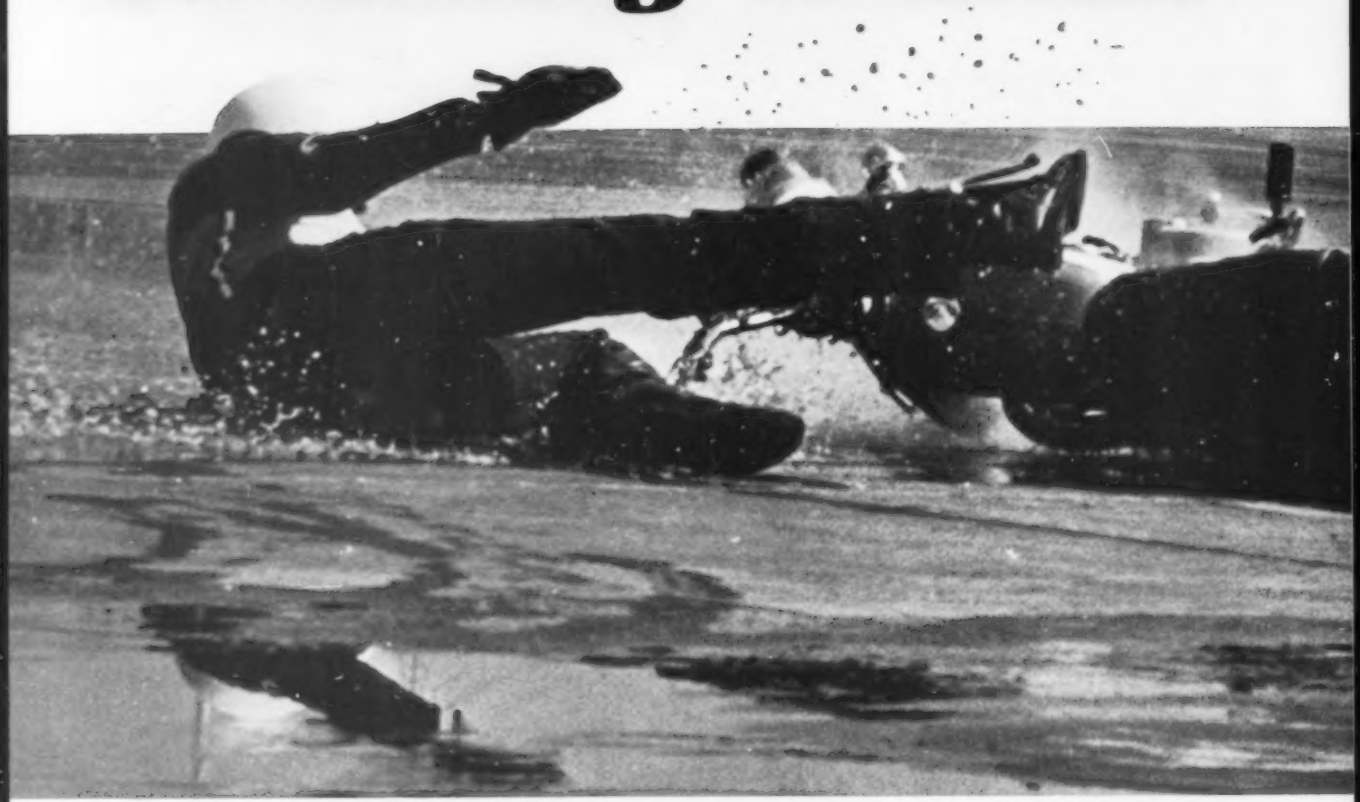
The Air Force officer and the high school teacher, fresh from the civilization of their friend's home, looked nothing at all like the rough, unshaven campers they had been a few days before. We were two pillars of America enjoying a relaxing and hard earned vacation in beautiful Utah. We were polite and obviously good old boys ourselves. The patrolman was impressed. Unfortunately, he was not so impressed with my skid marks, which clearly demonstrated the fact that I had crossed a yellow line in an attempt to pass. He was very polite as he explained the reason for the yellow line which was of course to keep people from passing near the angled road intersection. He offered to call a wrecker as he handed me the citation.

The ride back to Provo was a long one. We could have gone to another town which was a little closer, but paying motel bills for a week appealed to us about as much as camping in the parking lot of the auto body shop. Making the phone call was a difficult and embarrassing thing to do. Our friend was of course happy to put us up while the car was being worked on but, after a week of staying in a place you really don't want to be, even good friends get tired of one another. We pretended that we were enjoying the stay, while our friend and our new friends pretended they were glad to have us. We have had lots of fun, considering the fact that we had nowhere to go while they went to work every day, so the time was not a total disaster. The number of beautiful, single women in Provo is truly amazing and we were able to meet several. But everyone knew we were there under duress and would leave within minutes of the earliest opportunity. A third of my precious leave time, which I regarded as priceless, was spent in this less than perfect situation.

Five hundred dollars deductible insurance may be a wise move for someone who never has an accident. I'll confess to a brief period of asking myself how I could have been so stupid as to have such a high deductible, but actually I would have gladly paid the entire amount of the bill myself if doing so would have sent us on our way sooner. We began to wonder why we had driven so fast and so far. It no longer made any sense. What THEY had said kept going through my mind. We realized that we had been fatigued the whole journey, beginning with Steve's 24-hour bus trip and my hurried return from a bad alert with negligible sleep. Then we had foolishly blasted off before first light and just a few hours after I was legally free to leave town. Spending a week cooling our heels gave us plenty of time to get rested up and ponder the unseen forces within our natures which had propelled us across such a great distance in so short a time with so little rest. The virtues of a shorter, less hurried trip suddenly became evident. We had finally learned (and unfortunately experienced) why THEY in the Air Force and other thoughtful institutions recommend taking things a little easier, but that knowledge was little consolation. I just wanted to go home!

I am happy to report that my brother and I had a wonderful vacation this past summer. He drove out to Cheyenne in his new pickup, taking it easy along the way and getting plenty of rest. We took a drive down into Colorado, stopping often to enjoy the scenery and stopping to camp early enough to do some exploring around our campsite. We followed THEIR driving advice. We didn't cover that many miles, but we saw just as much and I think we enjoyed it more. Maybe we're just settling down. Maybe we're just getting old. Maybe we don't push ourselves so hard these days because now WE have become THEM.

Braking is a "10"



Ask most motorcyclists to rate braking as a critical skill on a 1 to 10 scale and they probably say, "10." While they're correct in rating braking as a very critical riding skill, many cyclists don't treat it as such when it comes to learning and practicing.

For example, a young man was rapidly riding down a series of curves when he came to one much faster than he wanted. He locked his rear brake and left 138 feet of rear wheel skid marks before losing control and dumping the bike. The motorcycle slid another 60 to 70 feet before it hit a guardrail. The rider slid fast enough to catch up to a truck traveling about 40 mph and went under the dual rear wheels.

The point here is that the motorcycle he was riding was capable of shaving 60 mph off its speed in the distance that he slid using only the rear brake, *if he had used both brakes properly.* If he had been traveling at a legal speed he would have stopped before getting to that turn. Even at the speed it was estimated he was traveling he would have been going much slower than the truck when he got to the curve had he used both brakes properly.

A motorcycle has two brakes and in order to stop effectively you have to use both of them.

Everybody has probably heard the old saying, "Don't use the front brake — you'll go over the handlebars." Well, it just isn't so. The front brake is the more important of the two brakes. Because of forward weight shifting during braking, the front brake can provide from 70 to 80 percent of your stopping power.

While the rear brake is probably sufficient for most stops, exclusive use of the rear brake may lead to overdependency on it. If you use only the rear brake for normal stops, you may not have enough skill to use the front brake properly when you really need it.

By applying both brakes at all times, you develop the skill needed to do so in situations where maximum braking is required.

Both brakes must be applied at the same time. Some people believe that the rear brake should be applied first; however, this delays application of the most effective front brake. The sooner you apply the front brake, the sooner it will start slowing you down. Besides, due to a difference in reaction time between the hand and the foot, the rear brake is usually applied slightly in advance of the front anyway.

The faster you're trying to stop, the closer each braking system is going to be to the point where the wheel locks and a skid develops. When a wheel locks it is no longer gripping the pavement but is floating on a thin layer of melted rubber instead. In extreme cases, when the wheels lock it will feel as if the bike accelerates because of the loss of braking action.

The rear brake is much less critical than the front brake, since it supplies only

(below)
If you squeeze the front brake lever too hard and lock the front wheel on wet pavement you're going to go down — no questions asked. However, if you learn to use the front brake properly, there's no danger.

a small fraction of the braking force. Under-application of it will not materially increase stopping distance, while the skid caused by over-application can generally be controlled through corrective steering.

However, when the front wheel locks and skids, it is unable to provide the quick directional changes required to maintain balance. Although less likely to occur than a locked rear wheel, when a front wheel locks it will cause the motorcycle to fall. At 40 mph a locked front wheel will cause the motorcycle to fall in only two-thirds of a second — faster than most people's reaction times.

At slower speeds — and provided you're straight up — when the front wheel locks you can come off the brake enough to allow it to unlock and still maintain balance. But if you're in a curve, the bike is going to go down.

This brings up another point that some people make incorrectly. They think it is dangerous to use the front brake in a turn. It is only if the road is very slippery and the brake is not used properly. Otherwise, it is only slightly more dangerous to use the front brake in a turn than it is when you're stopping in a straight line.

If necessary, a panic stop may be made by fully applying the rear brake and locking the rear wheel. This will allow you to pay full attention to controlling the front brake and generally results in a substantially reduced stopping distance. However, since the rear wheel is skidding, changes in direction cannot be made.*

Also in emergency situations the clutch lever is squeezed but without downshifting gears. If this isn't done, the engine will not slow down quickly enough and will prevent the rear brake from reducing rear wheel rotation at the fastest possible rate.

Reading all this theory or even talking with other cyclists isn't going to help you unless you get out and do it. You just aren't going to develop the skills until you practice them. And it is best to practice them under the control of a qualified instructor. (At the very least you'll want

continued

**In the panic stop situation (straight line) for all but the BEST PROFESSIONAL RIDERS the shortest stopping distance is going to be obtained with the rear brake locked. Only the best of the pros can manage to keep both front and rear wheels at that point just short of lock-up (the point at which maximum braking is obtained). For the average rider it is best to lock the rear brake and concentrate on keeping the front as close to locking as possible.*

The best way to learn proper braking is in a class under the close supervision of a qualified instructor.

When you're practicing braking skills every month it's a good idea to have at least one other person around in case you dump the motorcycle and get hurt.

EGO RIDER

You know the type: S/he walks with a slight limp and winces everytime anything including clothing touches certain sore parts of their body. And s/he will boast, "I laid my bike down rather than have an accident." Well, if you don't already know it, learn it here: Laying a motorcycle down *is* having an accident!

More than likely, if his or her ego wasn't speaking for him, what would come out of the mouth would be, "I screwed up and lost it."

If you want to lay a bike down you do it by locking the rear brake and starting to turn. The bike goes out from under you, and both you and cycle bite the pavement. Similarly, if you overbrake with the rear wheel and then try to maneuver around something, you're going down. Or, if you lock the front wheel you're going down.

OK, you say, what's so bad from going down instead of hitting that car that was making a left hand turn in front of you?

The first part of the reply is the rhetorical question: You mean aside from scraping the motorcycle all up, beating yourself silly on the asphalt and the all too common road rash?

The second, more serious reply is: Well, if it really were a matter of going down *instead* of hitting something it might be OK. But it usually ends up going down *and* still hitting the object. You see, a motorcycle can stop faster on its wheels than it can sliding on its side.

Today's road machines can generate about a full G of deceleration (32 feet per second squared) when both brakes are used properly. Even off-road bikes with their knobby tires can pull three-quarters of a G deceleration. However, a motorcycle sliding on its side on asphalt only generates about a G or *less.**

Therefore, at 40 mph a properly braking, upright motorcycle would stop in about 53 feet, while one that was sliding would require 107 feet to stop.

Don't become an Ego Rider. Learn to brake properly.

*SAE Paper 840250, Friction Factors for Motorcycles Sliding on Various Surfaces, by Terry D. Day and Jay R. Smith, Talbott Engineers, Inc.

At this point it's a little late to try to learn how to stop using both the front and rear brakes.

one other person around in case you dump the bike and get hurt.)

Motorcycle braking is a critical skill, basic to your chance of survival. It's not just a matter of squeezing the lever and stepping on a pedal. Braking requires lots of practice. Like any finely tuned skill, if you don't practice it regularly you won't have it when you need it the most.

You should practice your braking skills right to the limit at least once a month.

Most riders never really know what the limits of braking are (remember if you lock the front wheel, you're more than likely going down). Usually what happens is that they choose to remain just short of the limit and ride out the bad situation using other basic maneuvers — something that can't be done if the brakes are beyond the limit and the wheels locked.

On the other hand, paying attention to traffic and riding in a safe envelope, a motorcyclist should never come to that point to begin with. But the possibility is always there. After all, it is possible that you're going to have to brake hard because of somebody else's mistake. However, usually hard braking is required because of something you've done to get yourself into trouble.

Every bike is different. Even the same models with the same tires are different. Your bike's braking behavior will change with road surfaces. It will also change as the tires wear down. If you change anything on your bike including the tires, brakes, loading, etc., you're going to have to feel out your brakes all over again. Make lots of runs and take lots of practice.

Braking is a "10." You've got to know how to use your brakes. You've got to use them correctly. And, on special occasions, you've got to use them to the max.

HAZARDOUS HANGOVER DRIVING

The dangers of drunk driving are well known, but Sweden's National Road and Traffic Research Institute says driving with a hangover can also be hazardous. Even after eight hours of sleep and with tests showing no alcohol content in the blood, study subjects still experienced a 20 percent reduction in driving ability. The subjects still knocked over road markers on the test course and braking time was significantly increased.

EPA TO REVISE MILEAGE LABEL

Starting with '85 models, EPA will change fuel economy label requirements from just city figures to adjusted city and highway figures.

The city figure is to be adjusted 10 percent down and the highway figure 22 percent down to correspond more nearly to real-world conditions like driver habits, maintenance and road and climate conditions.

FILING CAR ACCIDENT INSURANCE CLAIMS

Even in the most minor fender-bender, auto insurance claims have to be filed, and knowing which information to collect could avoid insurance claim problems later on. Keep a pad of paper and pen in the glove compartment of your car so you'll be prepared to take down the necessary information.

The first item to jot down on the pad is the date of the accident and the time it occurred. Ask to see the other driver's license. Copy down the driver's name and address, birthdate and license number. Note the state it was issued in and the expiration date. If the driver isn't the owner of the car, get the owner's name and address.

Ask to see the vehicle registration slip. Note the license plate number listed on the slip, the state the car was registered in and the registration expiration. Take down the make and model year of the car. Compare this information to the car and note the color of the vehicle. If the driver's auto insurance company name and policy number are listed on the vehicle registration, copy that down too, or ask for this information.

If the police were called, note the police officer's name, precinct number and location. If any witnesses are present get their names and addresses too.

Finally, diagram the accident and write a short description of what happened while the details are fresh in your mind.

TOO DRUNK TO DRIVE

In response to a number of calls we have had about the "Too Drunk to Drive" item in the March issue, the hand held detector that measures blood-alcohol concentration is marketed as the "Tipsy Tester" by a Texas company and should soon be available at drug and convenience stores for about $2. Harold Clark, president of Tipsy Tester Inc., notes that the tester isn't 100 percent accurate for everyone but can act as a guide to tell you when you shouldn't drive.

INFANT SAVED BY RESTRAINT

After examining the aftermath of a severe motor vehicle crash last October, Jacksonville, Florida, police officer R.K. Johnson was quoted in the *Jacksonville Journal* as observing: "If that baby wasn't in a child restraint seat, she would have been seriously — very seriously — injured. And if she wasn't on the left side of the car in the rear seat as she was supposed to be, she would have definitely been killed. I have no doubt of that."

DOT CAUTIONS PARENTS ON CHILD SAFETY SEAT INSTALLATION

The Department of Transportation has cautioned parents about a potential safety problem involving the installation of some child safety seats in passenger vehicles.

The department's National Highway Traffic Safety Administration (NHTSA) said the potential problem concerns the compatibility of some child safety seats and manually adjustable seat belts. Child safety seats rely on vehicle lap belts to hold them securely in place.

A preliminary NHTSA review found that the situation may occur when the child safety seat is installed with the kind of lap belt that is not automatically tightened by a retractor. In some instances, the angle at which the belt is buckled is the same angle that permits adjustment of the belt length. As a result, the belt — and the child safety seat — may not remain secure in a crash. The potential problem does not involve child safety seats that are installed with a tether anchorage strap.

NHTSA Administrator Diane K. Steed emphasized that the potential problem does not involve a defect with the safety seats themselves and the parents should not be unduly alarmed. "Child safety seats are well-made, safety tested, and extremely effective in protecting child passengers. They have a history of life-saving successes when used properly," she said.

According to Steed, the manufacturers of child safety seats have been notified about the problem and asked to review the compatibility of their products.

Meantime, she urges parents first to install the child safety seat, carefully following the manufacturer's instructions. In doing so, they should inspect the installation, making sure the lap belt is tightly cinched. (If necessary, twist the short end of the buckle several times to shorten the length of the belt to enable it to cinch tightly.)

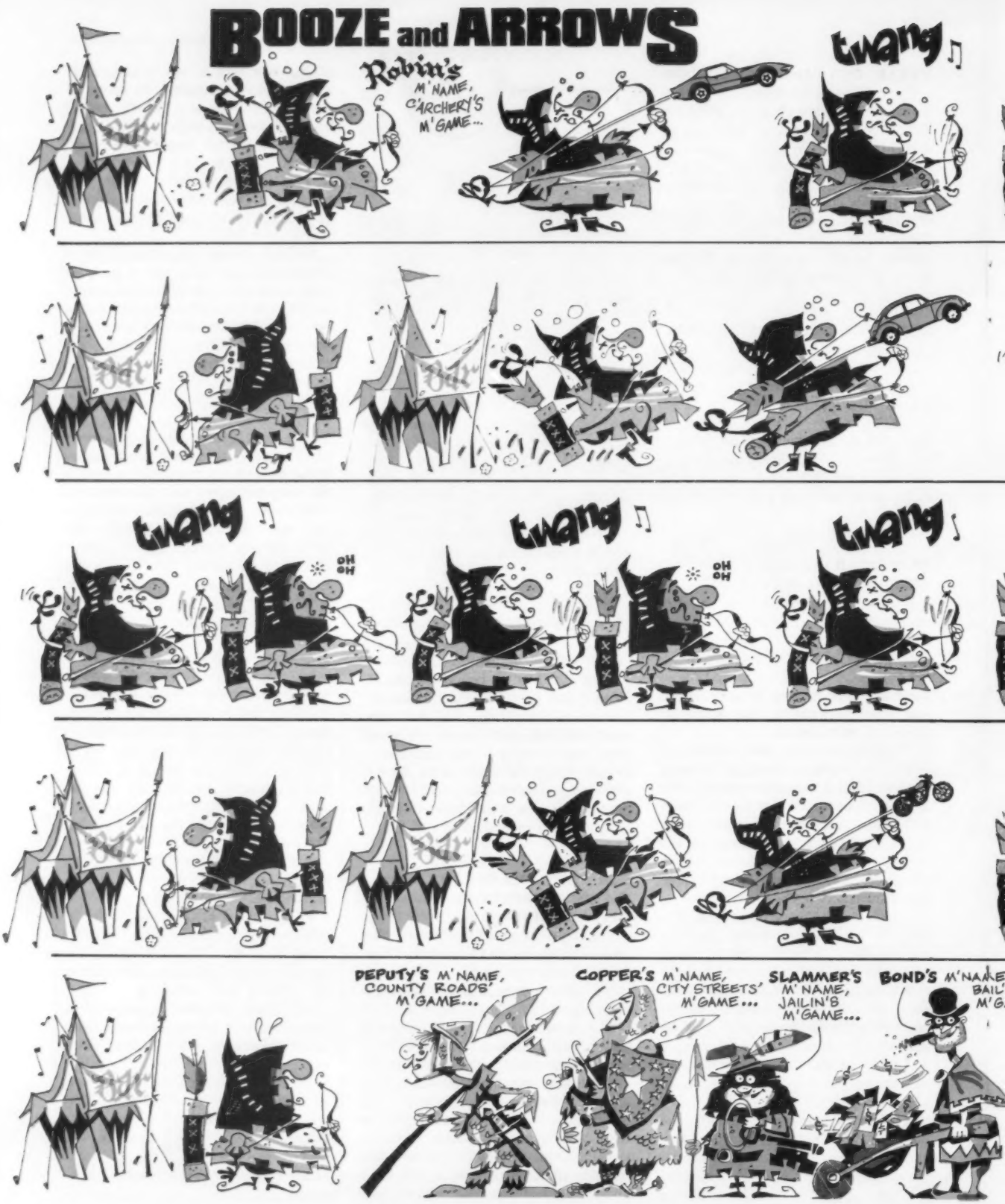
Next, parents should try to tilt the seat forcibly to the side to see if the lap belt holds it securely in place. She stressed that tilting the seat was important because the belt loosening problem may not be noticeable when the buckle is first attached. In some instances, the belt may appear to hold the safety seat firmly in place but later work loose when the child moves around.

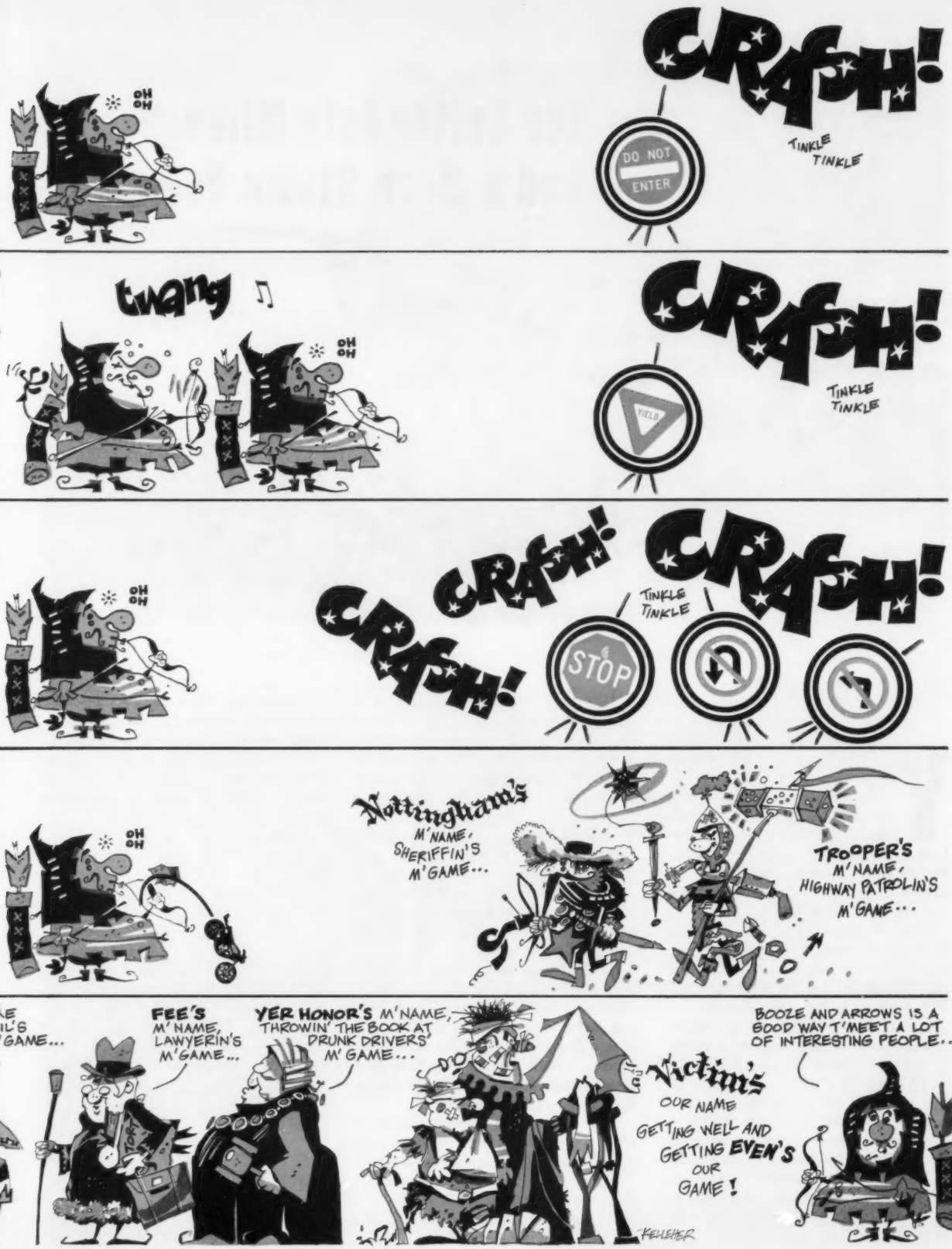
If after tilting, the belt slips through the buckle, she offered this additional installation advice for parents:

- Turn the adjustable end of the lap belt upside down (180°) before inserting it into the buckle. This effectively defeats the adjustment mechanism and prevents the webbing from loosening.
- If these remedies do not work in your vehicle, try placing the child safety seat in a different seating location in the car.

NHTSA encouraged parents who have encountered this or other child safety seat/seat belts compatibility problems to report them to the agency's toll-free Auto Safety Hotline on (800) 424-9393 (426-0123 in the Washington, D.C. area).

BOOZE and ARROWS

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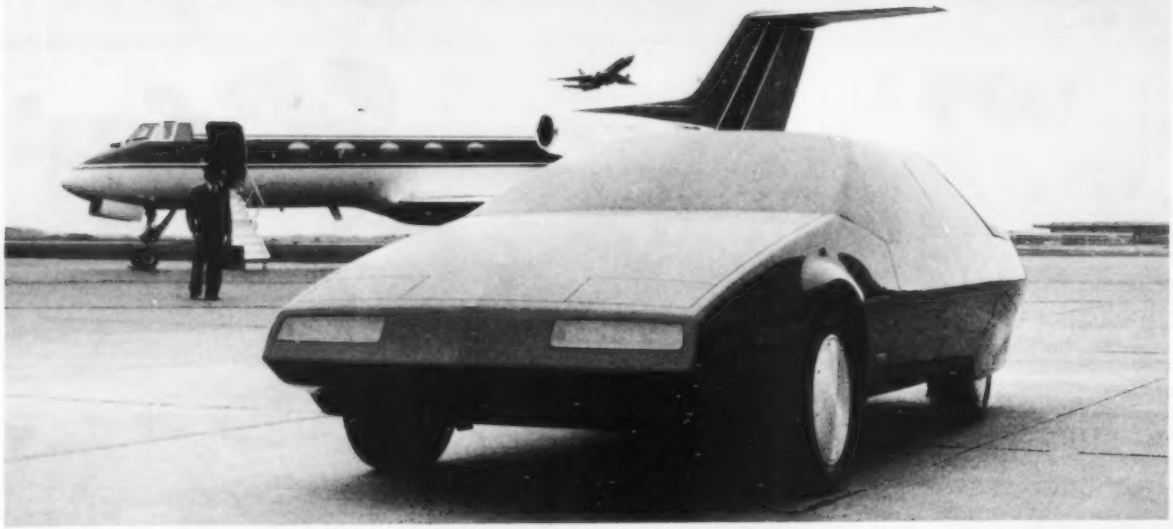
Nottingham's M'NAME, SHERIFFIN'S M'GAME...
TROOPER'S M'NAME, HIGHWAY PATROLIN'S M'GAME...
BAIL'S M'GAME...
FEE'S M'NAME, LAWYERIN'S M'GAME...
YER HONOR'S M'NAME, THROWIN' THE BOOK AT DRUNK DRIVERS' M'GAME...
Victim's OUR NAME GETTING WELL AND GETTING EVEN'S OUR GAME!
BOOZE AND ARROWS IS A GOOD WAY T'MEET A LOT OF INTERESTING PEOPLE...
KELLEHER

Aerospace TRICKS for Better Auto Mileage and a More Stable Vehicle



1st Lt. RANDY HAGAN
Air Training Command

You can't feel it, but it's pushing against you right now.

The atmosphere around you puts about 14.7 pounds of pressure on every square inch of your body. Whenever you move, you change that pressure. Walk and you'll push air in front of you, move it around your body and settle it behind you.

That, in effect, is a description of aerodynamic study — the movement of air around a given shape. Channeling that movement around shapes in a certain pattern is called airflow management.

One of the first products of airflow management was the wing. By creating more pressure below the wing than above it, the wing lifts itself . . . and whatever it's connected to . . . off the ground.

Some of the latest products of airflow management, though, are not meant to fly. Automakers in Detroit are beginning to use the same tools and techniques aircraft engineers have already refined to make new cars more fuel-efficient than ever before.

"It's really a new business for us," said Larry Socha, manager of Ford Motor Company's exterior design and aerodynamics department. "We've been in the aerodynamics business for less than 10 years now and it's truly amazing."

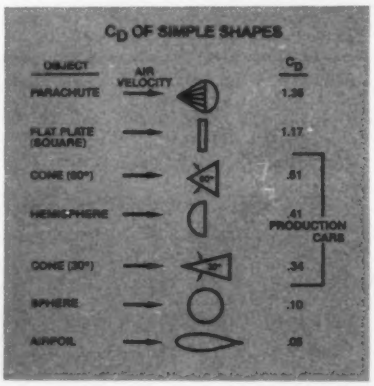
Automotive aerodynamics is a high-tech business, dealing with designing slippery cars that get superior gas mileage. While aircraft designers want to create disruption in the air-flow to make planes lift, car designers are working to move cars through the air with as little disruption as possible.

By using huge fans to blow 100 mph-plus winds across an auto shape in a chamber called a wind tunnel, engineers can make measurements of how the design disrupts airflow. Engineers then figure a Coefficient of Drag (Cd) as a rough measurement of how efficiently that design cuts through the air.

That Cd does not take the size of an object into account; only the shape of it (see Cd sidebar). The lower that figure is, the less wind resistance the shape offers. That translates directly into how much wind resistance the car will generate as it goes down the road.

Average Cds for today's automobiles range from .50 to .35, although some sporty models generate Cds as low as .30. Experimental aero designs by both Ford and GM are now in the .15 Cd range, roughly the same as current Air Force fighters.

Amazing indeed . . . and expensive. Research and rental time at Lockheed Aircraft's Marietta, Ga., wind tunnel has cost Ford more than $8 million since 1977 and has made the auto manufacturer



Lockheed's biggest customer. General Motors recently built a multi-million dollar wind tunnel facility next to its design center in Warren, Mich., and has spent even more on aero research.

Even after that, industry executives say, automotive aerodynamics research is far behind where aircraft technology is today.

"We're about where aircraft designers were in the early 1940s on aerodynamic modeling and effects," Socha offered. Unlike automobiles, he said, aircraft only interact with the ground on takeoff and landing where a lot of aerodynamic detailing is unimportant. "The research is just beginning with interactions between road surfaces and aerodynamics."

Also, aircraft benefit from Computer-Assisted Design programs. Aerospace engineers can "test" designs by computer in minutes, because enough wind tunnel research has been done to develop computer programs that simulate flying conditions. Aircaft designers can draw designs on the computer, try them and reject mistakes in minutes.

continued

THE SHAPE OF YOUR CAR

A drag coefficient (Cd) is a non-dimensional number used to describe the efficiency of a shape's airflow. Auto Manufacturers use Cd figures as advertising tools to emphasize a car's fuel efficiency.

Those numbers are entertaining, but not necessarily informative. If a luxury car like the 1984 Lincoln Mark VII has the same Cd as, say, Pontiac's 1984 Fiero, that doesn't mean they are as fuel efficient. It only means that their aerodynamic efficiency is the same.

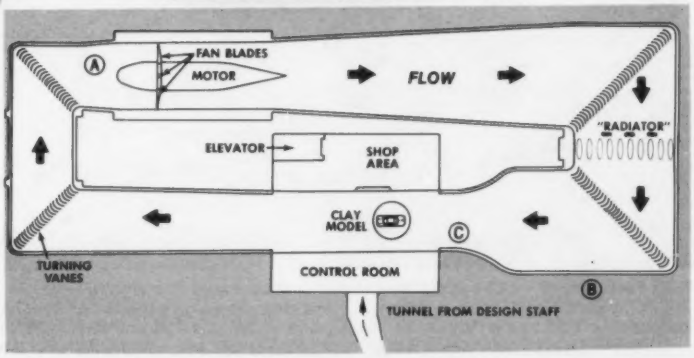
Fuel is consumed by a car's motor to overcome the forces resisting that car's motion. Just as a big V-8 is going to consume more gasoline than a small four-cylinder, an aerodynamic big car will eat more gas than an aerodynamic small one.

Auto manufacturers are changing their advertising to reflect this fact. Many new advertisements list a figure called "Aero Horsepower." That is the amount of energy it takes for the design to overcome aerodynamic friction and maintain a constant speed, without head, tail or side winds; uphill or downhill grades; or mechanical friction from the engine, transmission and drive train losses.

Another figure manufacturers use is measured in CdA, or the coefficient of drag times the frontal area (length times width of the front of the car), which takes into account the amount of sheetmetal a car pushes through the air. Although this figure gives a more accurate picture of a car's aero efficiency, it doesn't necessarily reflect the car's fuel efficiency.

Just like E.P.A. mileage figures, these measurements don't mirror your car's performance and should be used for comparison only.

Blowin' Them Away — Wind tunnels used to be the main tool aerospace engineers used to design fast, stable aircraft. They're still used for that, but today they are also used by the automobile industry to squeeze more miles per gallon out of their products. General Motors' wind tunnel uses a 3,000-horsepower electric motor to drive a 43-foot diameter fan (left) that pushes air at speeds of up to 150 m.p.h. The airstream runs a rectangular course (lower right) past the test model and back to the fan. Engineers in the control room (upper left) monitor the airflow and report test results to the designers.



aerospace tricks for better auto mileage and a more stable vehicle

continued

"We're past the trial and error stage. We know how well it will do if we give a car a fastback within X height," said Socha, "but the research we've done isn't as advanced as aerospace research yet, so the programs don't exist. We do a lot more wind tunnel testing than the aircraft industry does because they can do it on computer. We just don't know much about it yet."

The end result, Socha explained, is actual wind tunnel testing that can take days to achieve the same results aerospace engineers can get in minutes.

Still, the auto industry maintains, aerodynamics research dollars are well spent. Early experimental designs like GM's Aero X study could increase E.P.A. combined city and highway mileage by 6 m.p.g. over a Chevrolet Citation using the same drivetrain.

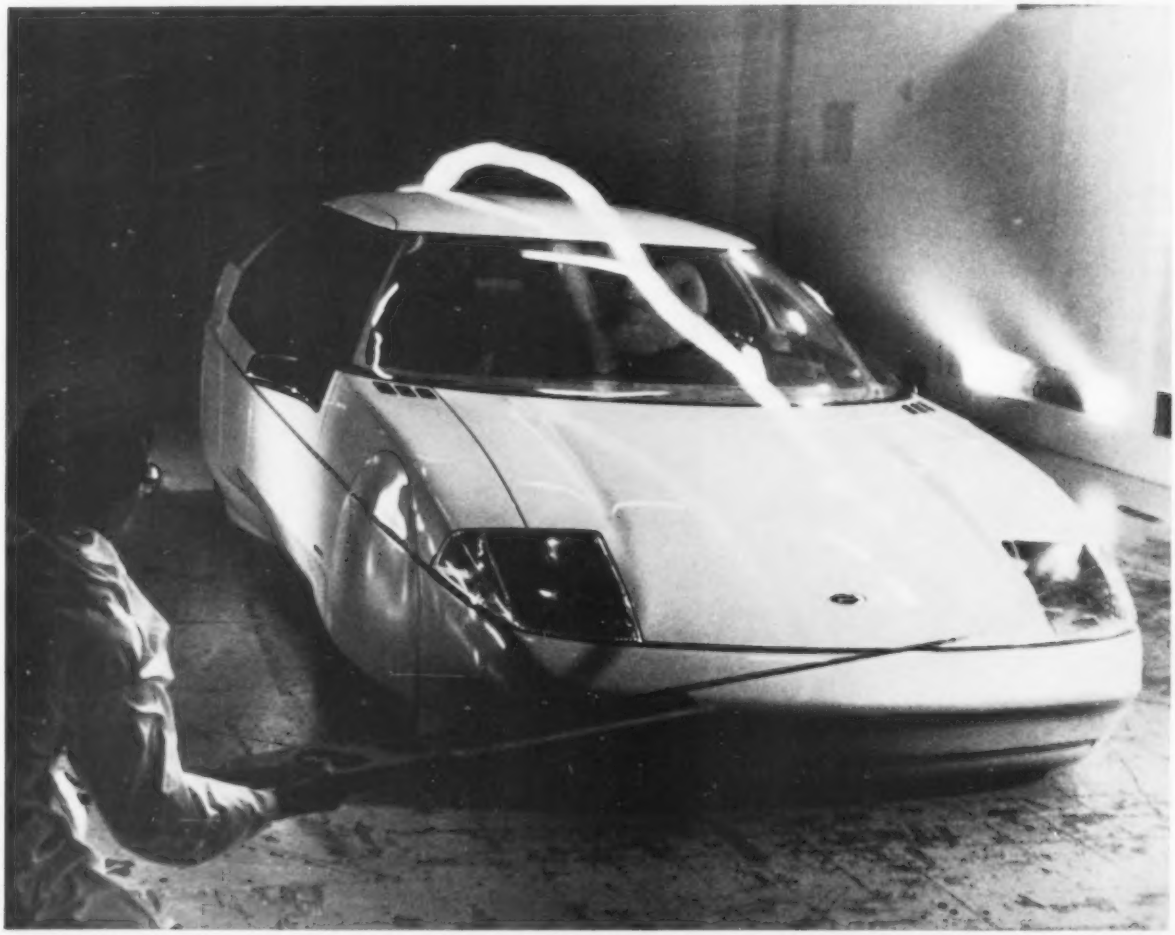
Without the aerodynamic body, a stock Citation would have to weigh 800 pounds less to get the same mileage. That would require extensive use of lightweight but expensive materials and probably require special manufacturing techniques that would cost Chevrolet millions of dollars a year. Those costs would be passed on to the consumer in increased car prices.

Those improvements come from decreasing the Cd from .45 to .25, a 45 percent improvement. As far as development goes, the goal was passed a long time ago.

Ford's latest aerodynamic study, the Probe IV, and GM's latest design, the Aero 2002, both register near .15 Cd. Ford's car is built on a production Escort drivetrain; GM's is a model based on the Citation drivetrain. Both cars can seat six passengers.

The Probe IV has neared 70 E.P.A.-rated highway miles per gallon in testing, while the production Escort is rated near 40. GM estimates the Aero 2002 could reach 65 E.P.A.-rated highway miles per gallon, while the stock Citation pulls 39.

Even though aerodynamic research is expensive, it costs a lot less than other options. As manufacturers strive to meet Congressionally-mandated mileage goals — the Corporate Average Fuel Economy figures — or pay staggering fines, aerodynamics play a significant role in the effort. And sheetmetal redesigns cost less than engineering solutions.



F-15 Four Door? — An aerodynamic engineer at Lockheed Aircraft's wind tunnel uses a smoke plume wand to measure the aero efficiency of Ford's experimental Probe IV prototype. The design, based on a production Ford Escort powertrain, is the most aerodynamically efficient running prototype built by the industry as this is being written. It's drag coefficient (Cd) of .15 is roughly equivalent to current Air Force jet fighters.

"Our researchers say that engineering spends roughly $100-$200 million for weight reduction or motor modifications to raise the CAFE .1 miles per gallon," Socha related. "Over the last six years, we've spent $8 million to raise the CAFE 1 mile per gallon. The way I figure it, we've saved Ford a billion dollars."

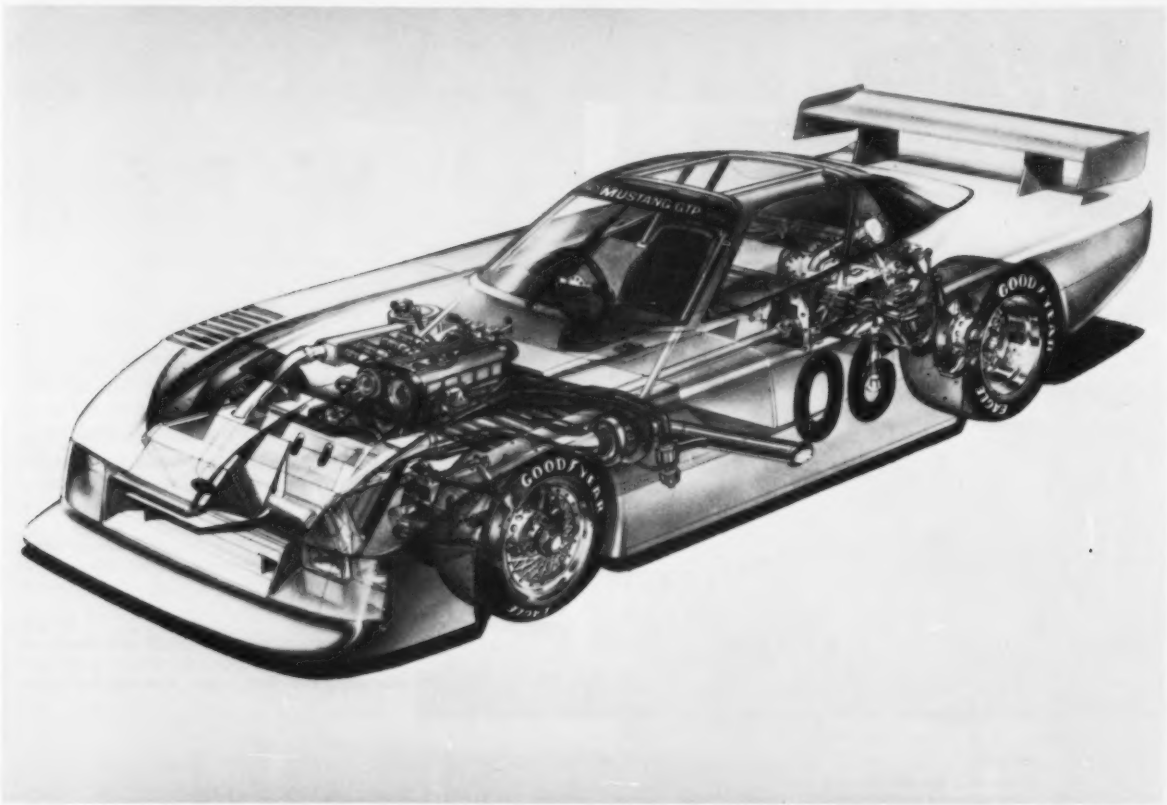
Irvin Rybicki, GM vice president in charge of design, said, "Our Aero studies demonstrate an experimental concept that uses technology still under development and cannot be converted into production cars overnight, but it does represent where we're going in offering better cars to our customers."

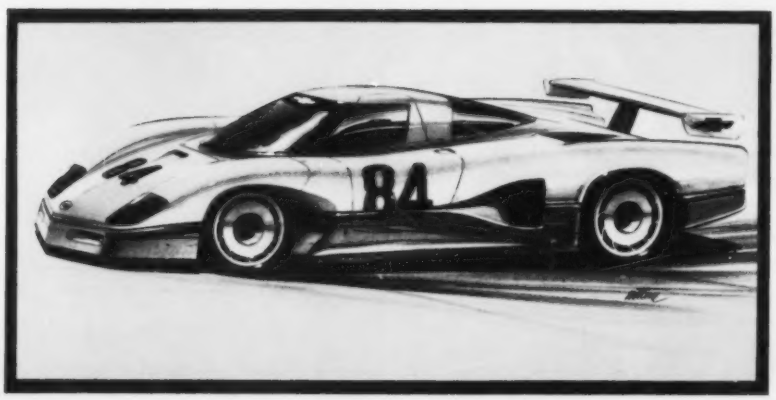
Ford's Socha added, "The aerodynamic engineer that worked on the Probe I prototype also worked on the '83 Thunderbird, which has a Cd of .36 and is one of the slipperiest designs we've ever produced. Our research engineers work on production programs too."

Aerodynamics offer car buyers more than increased fuel efficiency, as well. "Not only does aerodynamic fine-tuning increase fuel mileage," Socha said, "it also makes the car more stable to cross-winds on the highway and makes it stay cleaner because smooth airflow over a car cleans out any air pockets where dirt buildup and buffeting can occur. We feel the customer benefits all the way around."

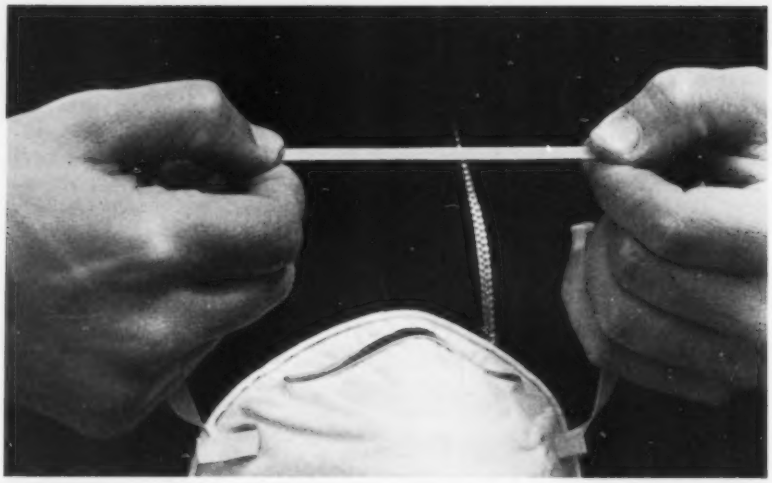
And as industry experts say, that's only the beginning as aerodynamic automotive research approaches the point aircraft technology achieved long ago.

"There's more to come. We've got cars coming like I've never dreamed of before," Socha hinted, ". . . and I've been in the industry a long time."





Flying Low — Modern race cars like Ford's GTP Mustang (top) and General Motors' GTP Corvette (below) look as much like rockets as autmobiles — for good reason. Both race cars use airflow management for better cornering and high-output turbo-chargers and intercoolers for more power. This same technology was developed in World War II for fighters like the P-47 Thunderbolt and the P-51 Mustang as planes approached the speed of sound.

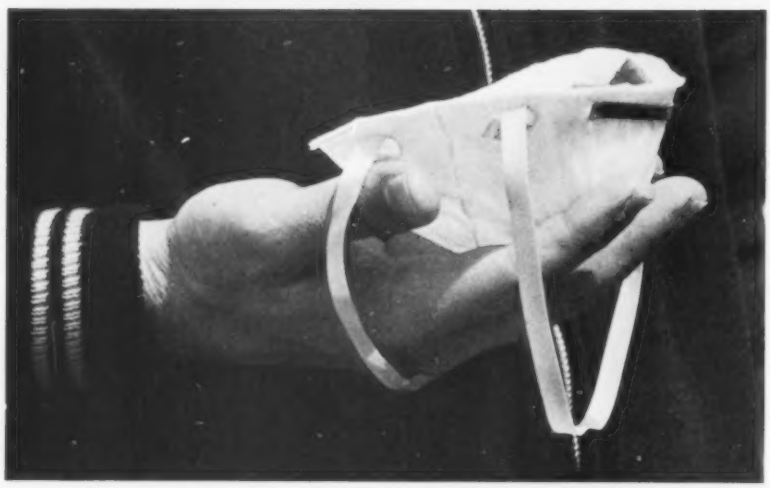


Before wearing, pre-stretch each strap by grasping and pulling the strap between both hands at 1-2 inch intervals around the entire length of the strap.

WEAR IT RIGHT

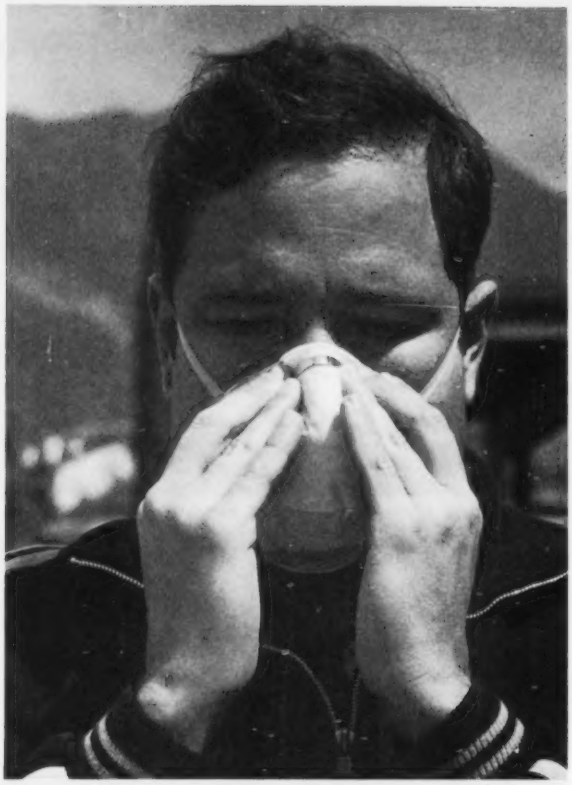
When working on car brakes, there is an ever present danger of asbestos dust. The Backyard Mechanic series has always warned against breathing this dust and recommended that pressurized air NOT be used to blow the brakes clean of accumulated dust.

The best way to avoid breathing the dust is to wear a dust mask such as the 3M brand respirator shown here. For the mask to do its job it has to be fitted properly when worn. Following these simple step-by-step instructions will ensure a good fit.



(above)
Cup the mask in your hand with the nosepiece at your fingertips, allowing the headbands to hang freely.

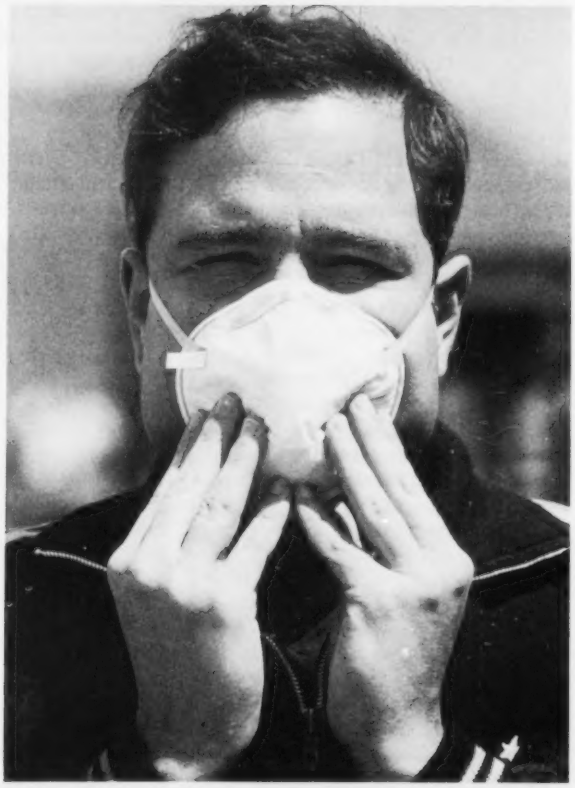
Cup the mask under your chin with the nosepiece up.

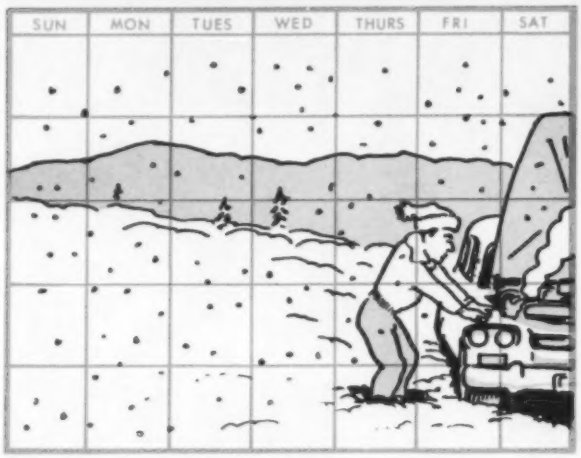


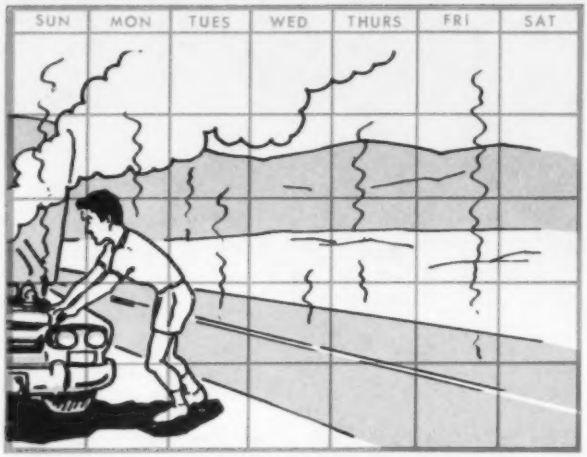
(above)
Pull the top band over your head and position it at the top back of your head. Then pull the bottom band over your head and position it around your neck, below your ears.

(above, right)
Using both hands, mold the metal nosepiece to the shape of your nose.

(right)
To check the fit, cup both hands over the mask and exhale vigorously. If air flows around the nose, tighten the nosepiece. If air leaks at the mask's edges, work straps back along the sides of the head.







All-Seasons Coolant

With engine internal combustion temperature reaching 4,500 degrees Fahrenheit it's easy to see the need for a good cooling system. An engine would quickly destroy itself as lubricated parts such as pistons exceeded 400 degrees if something didn't draw the heat away.

Most cars circulate liquid around the cylinders and heads to conduct heat away from the engine. (Yes, there are some aircooled engines, but these are becoming fewer every year.) Once the liquid has circulated in the engine block picking up heat, it is pumped from the engine into the radiator. At the radiator, air moving past the core because of the vehicle's speed and with the help of a fan draws the heat out of the liquid. The cooled liquid is then returned to the engine to repeat the cycle.

Of course the liquid can't circulate and cool the engine if it is frozen. When water freezes it forms solid ice and expands approximately nine percent. There is enough force in this expansion to crack the engine's water jacket while seriously damaging the radiator and other parts.

As little as a 10 percent solution of anti-freeze is enough to keep the ice from damaging either the engine or radiator. With this little anti-freeze in the system there is 90 percent ice crystals surrounded by 10 percent liquid anti-freeze. And although this is a thick semi-liquid mixture, it is unable to produce enough pressure to do any damage.

Of course, the ideal is to have enough anti-freeze in the system to give full protection to the lowest cold-weather temperature anticipated. Equal parts of anti-freeze and water won't form ice until 34 degrees below zero, compared to water's normal freezing temperatures of 32 degrees above zero. The maximum ratio of two parts anti-freeze and one part water doesn't turn solid until 92 degrees below zero.

As unusual as it may seem, when the temperature drops below the range of the anti-freeze, overheating is the end result. As the temperature gets colder, more and more ice crystals form in the bottom of the radiator core and/or lower hoses. Eventually, these lower areas become clogged with slush ice and the water in the engine's cooling jacket boils from the internal combustion temperatures causing the car to overheat on the coldest day of the winter.

At the other end of the scale, ethylene glycol-based anti-freeze mixed with equal parts of water raises the boiling temperature of the mixture from water's 212 degrees to 227 degrees at sea level. The ideal two-thirds anti-freeze, one-third water ratio lifts the boiling point to 238 degrees.

If you don't have a temperature gauge to tell you your coolant is getting hotter than normal, you might be in for a rude awakening. Especially if you think a temperature warning light is going to save you and your engine. Most temperature warning lights will not come on until the coolant reaches 250 degrees, and that is well above the boiling point of a non-pressurized system.

Fortunately cooling systems are pressurized, which raises the boiling temperature even higher. With most car cooling systems pressurized at 15 pounds per square inch (psi), the boiling point is raised 37 degrees. Therefore, the normal cooling system with a 50 percent solution of anti-freeze and water has a boiling temperature of 264 degrees at sea level.

Sea level is mentioned because the higher above it the car is, the lower the boiling temperature. For example, water boils at 212 degrees at sea level, while at 5,000 feet it boils at 202 degrees. Should you be crossing the Continental Divide, the boiling temperature of pure water would be lowering toward 184 degrees.

Today's anti-freezes (which more accurately should be called coolants) also inhibit rust as well as lubricate the water pump. However, over time they lose their potency and have to be replaced. That makes the annual draining, flushing and replenishing of the cooling system, one of the best periodic maintenance programs.

Proper cooling system preventive maintenance starts with keeping the coolant level correct. The radiator coolant level should be checked at least once a month.

If the coolant level is too low there may not be proper circulation at low engine speeds and at high speeds too much air

When using any radiator flush, it's important to read the directions first.

will be mixed with the liquid. Small air bubbles trapped in the coolant increase the fluid's volume and decrease the cooling system's effectiveness. Because of the increased volume, liquid is forced out the overflow pipe. This leads to a serious water shortage in a very short time.

The air also reduces heat transfer and may raise engine temperatures high enough to cause overheating. In addition, the presence of air in the coolant increases system rusting as much as 30 times. In turn, the rusting clogs the radiator and may hold enough heat in other critical engine areas to cause hot spots which form steam, leading to additional coolant loss.

When air is trapped in the coolant, the result is referred to as foaming. It doesn't appear to be a head at the top of the radiator, but gives the coolant a milky appearance while increasing the volume.

Overfilling the radiator can be just as bad as not filling it enough. Done continually, you will not be able to judge the system's condition. Overfilled systems don't have enough air space left to allow for expansion of the heated coolant, which must then be dumped out the overflow. And it is the anti-freeze that gets dumped, not the water.

As the coolant level rises and falls with engine temperature, check the radiator level at the minimum safe operating temperature. Then, if the system is clean, leak-proof and in proper working order, very little coolant will be lost. Therefore, the need to add large amounts of water indicates a developing problem.

Note that very little coolant will be lost in a good system, but nevertheless some

continued

Usually you start by opening the radiator drain cock and allowing all the old coolant to flow out.

After reclosing the drain cock you refill the radiator leaving enough room for the flush solution and then, of course, add the flush.

With the radiator cap in place (but only tightened to the first stop), run the engine for about 10 minutes.

You'll also want to examine the radiator overflow tube and the overflow reservoir.

coolant will be lost in normal operation. That's one reason why even the best systems have to be checked regularly. This is also why closed-system overflow reservoirs are so good: They collect the lost fluids and put them back into the system. If your car isn't so equipped, consider adding this inexpensive system as good insurance.

Of course there are other signs of leaking. When the coolant is cold, small leaks may show dampness or even dripping. However, when the coolant is hot, rapid

While you're waiting for the flush to do its work, check the condition of all the hoses and belts.

After the 10 minutes are up, turn off the engine, reopen and drain the system again.

evaporation removes any trace of dampness. When examining the cooling system, look for rusty or grayish-white stains as leak indicators.

The vast majority of coolant leaks and subsequent overheatings result from defective radiator pressure caps. Therefore, the radiator pressure cap should be checked at least twice a year or every 7,500 miles. Begin the check by examining the cap for bent tangs and its gasket for cracks or brittleness. Press the cap's spring; if there is not a very strong resistance, replace the cap.

Regardless of the cap's condition, replace it every third year or 40,000 miles.

As long as you have your hands on the pressure analyzer, do a complete system check. After wiping the filler neck clean, inspect it for bent parts and cracks. If the neck is damaged it should be cut off and replaced by a radiator shop. Next, remove the overflow tube and check it. Push a wire through the tube to clear any obstructions, being careful not to punch a hole in the tube. If the tube is not in good condition, replace it.

Following the cooling system analyzer instructions, attach it to the filler neck and pump the unit to 15 psi. Immediately check the upper and lower radiator hoses. Any bulges indicate weak hoses which must be replaced. Slowly dropping pressure means there is a small leak somewhere. A flashlight will help you locate telltale seepage, but you may have to feel for dampness in those areas you can't see.

Rapidly dropping pressure is the sign of a major leak which you should be able to find easily. However, if you don't find an external leak, you'll need to run other tests to uncover an internal one.

After running the engine a couple of minutes with the radiator cap in place, turn it off and pull the oil dipstick. Oil that looks white or has actual water globules in it may indicate an internal crack. If your car has an automatic transmission, pull the dipstick from it. A low automatic transmission fluid (ATF) level or water in the ATF point to a leak between the transmission oil cooler and the radiator.

The final test is for a leaking head gasket. Warm the engine until the ther-

continued

Close the drain cock again and refill the system with water. Start and run the engine for about five minutes.

Then drain the system for the final time.

Now retighten the radiator drain cock.

Fill the radiator with half the water first.

Once you're sure there are no leaks you can add the desired amount of coolant and top the system off with water.

continued

mostat opens (squeeze the upper radiator hose and you'll feel the coolant rush through when the thermostat opens) and then turn it off. After very carefully removing the radiator cap, attach the analyzer and pump in seven or so psi. Now restart the engine and race it. Should the analyzer needle fluctuate the head gasket is blown.

If you suspect a damaged head gasket and don't have an analyzer, put the overflow tube into some water. If the water bubbles when the engine is running with the radiator cap in place, you have head gasket trouble.

Some small leaks can be cured with stop-leak compounds, but not those that involve the pressures and heat of the combustion chamber such as around the head or head gasket. In any case, after adding a stop-leak compound, drive the car several miles and reexamine the suspect area.

All hoses are part of the semi-annual cooling system checkup. Squeeze all radiator and heater hoses firmly. Any that feel mushy or extremely brittle should be replaced. Look carefully for signs of splits while squeezing, because they have a nasty habit of bursting wide open under pressure. And don't forget the small by-pass hose between the water pump and block on some cars.

Pay extra attention to the lower radiator hose. This hose is lined with a coiled wire to keep it from collapsing. If this wire loses tension, the hose may partially collapse at high speed and restrict coolant flow, producing a very elusive overheating problem.

Regardless of their condition, all hoses should be replaced every third year or 40,000 miles. Use only those hoses designed for your vehicle since the universal or flexible hoses may restrict coolant flow. Keep in mind that installing only one or two new hoses may increase the system's pressure, causing older hoses to burst under the strain.

Before installing a new hose, clean the connection with a wire brush and coat the surface with a sealing compound. Place the new clamps (don't reuse old spring-type clamps no matter how good they look) on each end of the hose before positioning it. Once the hose is in place, slide the clamps to about a quarter-inch from the end of the hose for the best position on the fitting. Tighten the clamp just short of cutting into the hose.

All drive belts should be checked every six months, too. Replace any belt that shows wear, is cracked or glazed on the inside. Belt tension should be adjusted with a gauge.

If you don't have a belt tension gauge, adjust the belts until there is about a quarter to a half-inch of play when pressed between pulleys. Too much play means the belt is loose which results in slippage, rapid belt wear and the overheating of the engine. Overtighten the belt and it wears too fast, besides causing early failure of fan, water pump and other unit shafts and bearings.

Drive belts should be replaced every two years or 30,000 miles no matter how good they look.

Radiator clogging is another cooling system problem that leads to overheating. Allow the engine to run until it reaches normal operating temperature and then turn it off. Now feel different parts of the radiator surface with your hand, starting on the top center section. If some of the sections are warm to the touch while others are cool, the core is probably clogged and the radiator must be cleaned by a specialist.

Start and run the engine until the thermostat opens releasing any trapped air. Then you can bring the fluid up to its proper level.

To replace the thermostat, you are going to have to first remove the upper radiator hose.

Then remove the hose elbow connection.

This is where there should have been an old thermostat except that somebody had already removed it causing the engine to run cold most of the time.

The remaining units of the cooling system — the thermostat and water pump — should be replaced every seven years or 70,000 miles.

Do not consider operating the car for any extended period with the thermostat removed. Although less sudden in effect than overheating, overcooling can be equally harmful to your engine. Low engine temperatures, especially during cold weather, result not only in excess fuel consumption but also dilution of engine oil with unburned fuel and sludge formation from condensation of water in cylinders and the crankcase. Lubrication failure may follow sludge formation and lead to serious engine damage. Burned fuel vapors also mix with water in the crankcase to form corrosive acids which attack engine parts.

Believe it or not, operating the engine without a thermostat can cause overheating in the hot months. Without the thermostat to slow the flow of the coolant, the liquid may rush through the radiator too fast to be properly cooled which will result in overheating.

As mentioned earlier, the most productive preventive maintenance is the annual draining, flushing and refilling of the cooling system. With the new flush mixtures and inexpensive flushing kits available the job is hassle-free as you can see in the pictures on these pages.

Once you've decided on the ratio of coolant and water you intend to use, you can begin to refill the cooling system. Put in half the water first. That way, if you did forget to close or reconnect something, or if you have a leak, all you'll lose is water. Then add the amount of coolant necessary to produce the finished ratio of coolant to water. Now finish filling the system with water. Be sure to leave enough room for expansion. Start and run the engine until the thermostat opens, releasing any air trapped in the block. Now check the entire system for leaks (you may want to put the analyzer on again) and recheck the coolant level before driving the car.

Timely preventive maintenance should avert problems with hot cars, warped engines, hot tempers and expensive towing. But it's always a good idea to have a few items in the trunk for emergencies. Always carry spare belts and the tools to install them. While radiator hoses shouldn't give you any problems, a roll of tape and a few spare hose clamps can be useful for temporarily sealing small leaks or reinstalling popped hoses. A gallon of water or coolant is an excellent idea — if not for your vehicle, then for the other poor soul who doesn't follow a preventive maintenance program. A few rags can protect hands while working with hot cooling system parts or be stuffed into the radiator filler neck to temporarily replace a blown radiator cap.

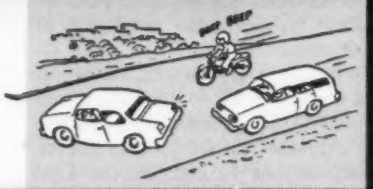
However, the best advice is still to check the coolant level regularly.

Put the new thermostat in place making sure that it is the right kind, opens at the right temperature and is facing in the correct direction.

After cleaning all the surfaces in installing a new gasket, add some sealant.

Now reinstall the elbow. After cleaning up the connection and applying some sealant to it, reinstall the radiator hose.

BACKFIRE
LETTERS to the EDITOR



MACHO-MUSH

The testimonial of A1C James K. Collins as "The Airman Behind the Curtain" in the March 1984 issue was very enlightening.

He mentions the impacts on his family — emotional as well as financial. This brings in some other dimensions for the final consideration on the use of seat belts, motorcycle helmets, etc.

The statement of his desire for a mandatory state helmet law is not appropriate. The decisions we make concerning our use of restraints and safety devices are our personal choices . . . our RESPONSIBILITIES. The only true way of handling this problem of safety device non-use is for us (family, friends, employers, associates) to convince the non-users. Mandatory-use laws serve only to bleed away the valuable time of our law enforcement officials.

Perhaps, being a He-man terminates when you become just Macho-Mush.

Capt. James W. Walstrom
Ellsworth AFB, SD 57706

OPEN LETTER TO PARENTS

To the parents of a bicycle rider: Last night I almost ran over your son. He cut across the path of my car on his bicycle. He had no lights and no obvious reflectors and was invisible until he turned across my headlight beams. My first reaction was fright — I had almost hit an innocent child! Fright gave way to relief, and relief to anger! Why would parents allow their child to risk his life so carelessly on an unlighted bicycle?

Bicycles must share the road with potentially lethal chunks of rolling steel, and their riders need all the help they can get. That includes proper night lighting which allows the rider to be seen before it's too late. A child on a bicycle weighs about 100 pounds or so — an average car weighs 20 to 30 times that much, and its skin is much tougher than a child's. In a collision with a bicycle rider, a car doesn't suffer broken bones, a fractured skull, or a crushed body.

This is not the first time I've had a close call with an unlighted bicyle, and that's partly why I'm so concerned. Parents, how much is your child's life worth? Is it worth the measly few dollars it takes to buy a set of lights and reflectors? Is it worth the couple of hours of your time it takes to install them? Think about that the next time you spend five bucks at the local fast-food stand, or a couple of hours watching television. For your child's sake, protect him before it's too late!

The next time I might not miss. . . .

Lt. Col. Morris E. Weathers, USAF
Norton AFB, CA 92409

DRUNK?

LEMORE, FIVE MILES. How often has someone driven by that sign and wondered "How did I get here?" I personally can identify with that feeling. Several years ago I blithely operated a motor vehicle while so full of alcohol that road signs looked like comic book characters. I've traveled anywhere from 20 to 100 miles and cannot remember how I got from one point to another.

The last 20 years of my life have been spent battling a disease that gives no quarter and takes no prisoners. Like a plague it totally infects one's life, job, home, marriage, financial security. Nothing is sacred when alcoholism has you in its grasp. But by far the thing that hurt me the most was the loss of self-respect and the self-worth that alcohol addiction invoked.

On too many occasions I have walked out of a bar or club and known that I have had too much to drink. I deluded myself into thinking that "one more for the road" would not, could not, impair my driving abilities. I've spent a lot of hours of my life behind the wheel of an automobile hoping that I would not get caught by the local law enforcement agency or highway patrol. One would suspect that the fear that I felt would keep me from drinking and driving. Not so! In fact, I used that fear to drink even more! I needed some kind of fortification (normally an extra nip or two from the handy thermos I kept for just such an occasion).

When alcohol has you by the throat, reality is just a word. I had read all the literature on drinking and driving, but they were just words printed on a page. To convince you that alcoholism dulls your perceptions of the real world, I would like to relate to you a real life incident of mine. For a period of 18 months while I was afflicted with this disease, I drove an ambulance and worked as a paramedic. I worked the scenes of countless alcohol related accidents. I saw firsthand the carnage that alcohol can and does cause. It did not affect my pattern of alcohol abuse one iota! In fact, all those bodies strewn about the highway caused me to drink even more. The more fearful I became of hitting someone or causing injury to myself, the more I told myself I needed a quick drink to fortify myself for the long drive ahead. I consider myself very lucky not to have injured anyone, but one cannot depend upon luck to save him from stupid errors in judgment, and believe me alcohol DOES cause you to make a lot of stupid decisions. If there was one job in this world that would make a person realize how dangerous and stupid combining drinking and driving is, it was the one I held. I can assure you that my alcohol intake increased while I was employed

driving an ambulance. Alcohol makes fools of all of us! No one is exempt!

What is the answer? *Don't drink and drive!* Contrary to popular opinion, you and your friends are not immortal! You owe it to yourself and to others who do not drink and drive to operate a motor vehicle only when sober and in full command of your faculties. Take it from one who knows, the only person you kid when you drink and drive is YOURSELF.

YN2 J.D. Parks, USN
Attack Sq TWENTY-SEVEN
FPO San Francisco 96601

Our lead article this month talks about the danger of drinking even lightly and driving, and of the difficulty of measuring the extent of one's intoxication.

WHO'S THE TOUGHEST?

I am disappointed in your answer to Capt Heilkkola's letter (Backfire, March 84), specifically your comment that "also good is the SCHA sticker." I was taught in the Motorcycle Safety Course given on base that there are four different groups testing helmets for safety. Each group uses a different set of standards.

The least stringent standards are set by DOT. The SCHA sticker indicates a slightly tougher set of standards. ANSI 290.1-1979 inside a helmet shows a better helmet yet. (I'm not sure, but I believe this has been replaced by a 290.1-1982, an updated test.) The SNELL foundation sticker indicates that the helmet has passed the SNELL standards, the toughest in the industry. Any helmet which passes SNELL will carry all four stickers. See your December 1981 issue for more details.

I won't go into brand names, but my helmet has all four stickers. It makes for a more expensive protection, but it is worth it. Like the manufacturer's slogan used to say, "If you have a $10 head, get a $10 helmet."

Many thanks for all the good articles in your publication. Driver is the only magazine I read cover to cover each month, and I always end up checking something either on my pickup, my bike or my own driving habits. Keep up the good work.

Capt. David A. Spencer
Hill AFB, UT 84056

A helmet that has a Snell sticker will NOT necessarily have a DOT sticker. Although tougher in many aspects, Snell is not always as tough as DOT when it comes to certain tests. If a helmet does not have the DOT sticker it is not legal to use that helmet on the street.

I AM A GOOD DRIVER

Monday, just like any other day, I was driving to work after lunch on my 750 Kawasaki. I am a good driver and have taken the Air Force "Hands On" motorcycle course (VII), and have about three years of experience on motorcycles.

I was traveling behind two other cars going up an overpass and felt annoyed that the lead car was going under the posted speed limit. After the bridge, the road widens out into two lanes where I would be able to pass them. Since the two cars were staying to the left I decided to take the right lane. I was about 100 yards behind the cars and accelerating when suddenly I noticed the cars slowing down and the right signal light of the lead car blinking. Immediately I hit the horn button and both brakes as the car turned into "my lane" to enter a shopping center parking lot.

Lucky for me that even though the sky was overcast, the road was dry. The tires squealed as the bike squirmed to a stop not more than a foot away from the rear door of the car. We both sat for a second before the man drove into the parking lot. I followed and I was angry! Why did the man make a right turn from the left lane? Glancing at the road I looked for the dividing line, and there wasn't one there! The dividing line did not start for a quite a ways down the road. So I would have been in the wrong! I had traveled this road so many times that I knew the road turned into two lanes but I was using it as two lanes before it legally became two lanes. Yes, the driver should have been over to the right before making a right turn, but I should have been exercising extreme caution when passing on the right.

At this point my anger passed and the fear of what had almost happened hit me. It could have been a very bad accident! My bike is in top shape mechanically; brakes adjusted correctly, good tires, headlight operating, etc. I was wearing all of my protective clothing items; a full face helmet, heavy gloves, jacket, boots and a yellow rain slicker over my jacket. But none of these is a substitute for wise and alert driving . . . defensive driving!

Looking at the other motorcycle riders in my squadron I wonder why most of them are new airmen. Do a lot of older AF personnel stop riding (motorcycles) because of an accident or near miss like mine? I am 29, have three children and a promising AF career. If I am to continue to ride, I will need to improve my driving habits even more, and continue to wear protective clothing, keep the cycle in top condition, etc. I *can* drive safely, but it should not take a near accident to make me do it. Can you learn by my mistakes? I hope so for the sake of us all.

TSgt. Stephen E. Engberg, USAF
Norton AFB, CA 92409

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Don't be a Skinhead

Military haircuts may not be all the rage (well, maybe they are with punk rockers), but your head would really look funny without any hair at all in the spots where this helmet took its beating. Remember to wear your helmet even when it's not required by local ordinance. And if you do have an accident, the helmet has lived its one life; buy a new one.